

THE UPPER PALAEOZOIC ROCKS IN THE NEIGHBOURHOOD OF TAREE, N.S.W.

By A. H. VOISEY, M.Sc., Linnean Macleay Fellow of the Society in Geology.

(Plate xxi; 3 Text-figures.)

[Read 30th November, 1938.]

The area which has been mapped lies between the towns of Wingham and Taree on the Manning River in the North Coast District of New South Wales. Taree is 235 miles by railway from Sydney.

It was only after the general sequence of the strata had been worked out in adjacent areas that geological mapping was found to be possible. Outcrops are not good and the boundaries of the units as indicated on the map are approximate.

Previous Literature.

In 1911 Dr. W. G. Woolnough made a reconnaissance trip through the Manning River District and briefly described limestones and possible glacial conglomerates outcropping alongside the Cedar Party Road. He compared these beds with the "Permo-Carboniferous" rocks of the Macleay River, which were described by him in the same paper.

In an account of the limestone deposits of New South Wales, Carne and Jones (1919) called all the limestones outcropping in the Manning River District "Carboniferous", probably on account of the presence of corals of that age found at Taree.

So far as I am aware this is the first attempt to describe in detail the general geology of the area and to map the beds therein.

STRATIGRAPHY.

DEVONIAN.

Banded claystones and tuffs of Devonian age, closely resembling those of the Tamworth Series described by W. N. Benson (1913) from the Tamworth District, outcrop south of the Manning River between the Brushy Cutting and Tinonee and north of the River between Bungay and Wingham. The beds are separated from Carboniferous strata by the Wingham Fault.

Excellent exposures occur along the road between Wingham and Tinonee, especially at the Brushy Cutting. At the north end of the Cutting is a coarse, dark green tuffaceous breccia resembling the type included in the Baldwin Agglomerates (Benson, 1913). With it are the banded claystones which, accompanied by massive beds of tuff, are seen all the way along the Cutting.

Green cherty bands are interbedded with the claystones and tuffs along the Bungay road from Wingham. The tuff bands may be traced for some distance on both sides of the road. Near Bungay a road-cutting reveals hard blue tuffs overlain by coarser tuffs which grade into a conglomerate containing rock fragments up to the size of a pea. They are associated with mudstones which weather to a

conspicuous malachite-green colour. All the beds in this Cutting dip in a direction 160 degrees at 30 degrees.

A road-material quarry on the top of the first hill east of the point where the Mount George road to Wingham crosses Dingo Creek reveals the banded claystones and tuffs which dip in a direction 100 degrees at 40 degrees.

As the banded claystones have not been examined microscopically to date, the presence of Radiolaria has not been proved. However, these organisms are abundant in similar rocks in the Tamworth (Benson, 1913) and Gloucester (Sussmilch, 1921) districts and may be expected to occur here.

So severe has been the deformation of the beds that no reliable estimate of their thicknesses has been made.

CARBONIFEROUS.

The Carboniferous sequence will be discussed under three headings: (1) Lower Burindi Series; (2) Upper Burindi Series; (3) Kullatine Series.

The Lower and Upper Burindi Series correspond with those of similar name in the Werrie Syncline and are of Tournaisian and Viséan age respectively (Carey, 1938; Carey and Browne, 1938). The Kullatine beds resemble those of the Macleay River area (Voisey, 1934a, 1936), but may be correlated also with the Upper Kuttung Series in the Werrie Syncline.

Lower Burindi Series.

Rocks belonging to this series outcrop on both sides of the main road most of the way between Taree and Wingham. The only reliable section which was measured extends from the vicinity of the Taree Rifle Range to Kolodong Station by way of the railway line and Kolodong road. The strata dip consistently in a north-easterly direction at angles averaging about 35 degrees.

An additional 500 feet may be added to the section by considering the succession between the Devil's Elbow and the Taree-Wingham road. It would appear from the lithology that greenish tuffs exposed in the first cutting east of Kolodong station are the equivalents of the "*Pachydomus*" horizon of Woolnough. This was located first at the Devil's Elbow railway ballast quarry (Woolnough, 1911). Such a correlation is supported by the presence of micaceous sandstones and felspathic tuffs above each massive tuff band. The "*Pachydomus*" horizon is near the base of the Kolodong section and in the middle of the Devil's Elbow section. A fault separates the two sequences and there is a violent change in strike.

The composite sequence has been calculated as follows:

	Approximate Thickness in feet.
Bluish-green tuffs with interbedded olive-green mudstones	425
Olive-green mudstones containing plant remains; bluish-green tuffs; light coloured "intrusive" tuffs; and micaceous sandstones	215
Mudstones and tuffs (inferred)	70
Sandy mudstones and greenish-grey tuffs	220
Mudstones and tuffs	145
Mudstones and tuffs (inferred)	500
Mottled and felspathic tuffs with interbedded olive-green mudstones	210
Mudstones and tuffs (inferred)	110
Felspathic tuffs, mudstones and micaceous sandstones	115
Massive greenish tuffs containing lamellibranchs (" <i>Pachydomus</i> " Horizon)	50
Tuffs and olive-green mudstones	450
Mudstones with marine fossils	20+
Total thickness	<hr/> 2,530+ feet <hr/>

The marine fossil bed at the base of the sequence outcrops about two and a half miles from Wingham in low cuttings on the south side of the road directly opposite a road quarry in a hill to the north. The forms collected from this locality follow: *Fenestella* sp., Crinoid stems, *Spirifer* cf. *pinguis* (Sowerby), *Spiriferina cristata* Schloth., *Spirifer striata* Sowerby, *Spirifer* cf. *striato-convoluta* Dun, *Orthis* (*Schizophoria*) *resupinata* Martin, *Phricidothyris lineata* (Martin), *Productus* sp., *Conularia tuberculata* Fletcher. [Specimens F 37807-26, Aust. Museum Collection.]

Massive greenish tuffs interbedded with olive-green mudstones comprise the next 450 feet of the section. These are overlain by the first bed of the Lower Burindi Series to receive mention in literature. This is the greenish tuff which was described by Dr. W. G. Woolnough in 1911 from the Devil's Elbow. It contains a great number of specimens of a small lamellibranch which was identified by Mr. W. S. Dun as "*Pachydomus*", but as it is Carboniferous in age such a name cannot be retained. Mr. Fletcher regards it as a new form. The tuff band is fifty feet in thickness and gives rise to unusually good outcrops so that it may be traced for some distance east of the Devil's Elbow.

The greenish tuff is a very common rock-type throughout the Lower Burindi Series, but occurs in beds of varying thickness separated usually by olive-green mudstone.

A very interesting group of rocks overlies the "*Pachydomus*" horizon. Interbedded with olive-green mudstones and bands of hard greenish tuffs are felspathic tuffs and micaceous sandstones. The felspathic tuffs are in beds from several inches to a foot in thickness. One type consists of idiomorphic to sub-idiomorphic feldspar crystals up to a twentieth of an inch in diameter set in a pale grey felspathic groundmass. Another is a darker grey containing white feldspar crystals and stained brown in patches by iron oxides. These tuffs weather to shades of brown but often have a white surface coating. Fragmental plant-remains were found in some of the bands.

The micaceous sandstones have been examined only in a decomposed state since they are soft, porous, and readily weathered. They consist very largely of mica, with some feldspar and quartz grains. A parting is well marked parallel to the lamination. The weathered colour is brown. This unusual rock occurs at intervals through some hundreds of feet of the sequence, but is usually only in beds several inches thick separated by mudstone.

On the hill just east of Wingham ferry on the Tinonee road the micaceous sandstones are interbedded with laminated mudstones which have dark and light grey bands and weather white. Arrow-head markings (Voisey, 1934a) are common. The dip is in a direction 120 degrees at 30 degrees.

The Kolodong section continues with olive-green mudstones and greenish tuffs with small beds of felspathic tuff for the next 1,200 feet. The mudstones do not make conspicuous outcrops since they are generally soft and crumbling, weathering readily to a buff colour. Some narrow cherty bands occur. These harder types are dark-grey or black in colour and have a conchoidal fracture. Unidentified plant-remains, usually only stems, are common in the mudstones.

The tuffs are greenish-grey or grey in colour and vary somewhat in texture and appearance. They are massive, hard, and outcrop as rounded boulders with a thin coating of the decomposed material. When more deeply weathered they become light brown or buff in colour.

A variant of the greenish-grey tuff is the mottled tuff which has a mottled appearance, the colours being shades of greenish-grey or brownish-grey. The mottling effect may have been produced through the weathering.

About 100 yards along the Kolodong road from the turn-off near the overbridge, the mudstones contain light-coloured tuffaceous material apparently intrusive along cracks. This, then, is another locality in which the phenomenon of "intrusive tuff" is developed.

A zone consisting principally of greenish-grey tuffs with subordinate olive-green mudstones comprises about 425 feet of the sequence and is splendidly exposed by the railway cutting under the overbridge on the Wingham road about two miles from Taree. It gives rise to a well-marked physiographical feature and continues southwards as a ridge into which the Manning River is cutting.

The top of this zone is regarded arbitrarily as the upward limit of the Lower Burindi since outcrops are very scarce between the tuffs and the Taree Limestone in the Upper Burindi Series.

Upper Burindi Series.

A calculated thickness of 400 feet of soft sediments occurs between the top of the Lower Burindi Series and the base of the Taree Limestone. Poor outcrops render adequate description impossible, but from the limited information available it appears that they consist largely of fine-grained sandstones and mudstones light-grey in colour and weathering buff.

A road-material quarry just east of the overbridge on the old Port Macquarie road near the limestone quarry at Taree reveals thinly-bedded, sandy mudstones and bluish-grey tuffs. Plant remains are abundant, but too fragmental for identification. The dip is variable in the quarry owing to the presence of faults. It ranges from 40 degrees to 60 degrees in directions from 350 degrees to 45 degrees.

Across the Dawson River bridge on the road from Taree to Cundletown is a small quarry on sandstones and mudstones containing crinoid stems. These resemble the Upper Burindi beds and may belong to the sub-limestone zone.

The Taree Limestone outcrops in the following localities:

1. In the railway cutting where the old Port Macquarie road goes over the railway line. (Portion 17, Parish of Taree.)
2. On both sides of the old Port Macquarie road just east of the cutting mentioned above. (Portion 18, Parish of Taree.)
3. In a quarry situated about a quarter of a mile north of the railway line near the point where it is crossed by the Wingham road about two miles north of Taree. (Portion 1 and M.L.1, Parish of Taree.)
4. In a quarry just west of the Cedar Party road near its junction with the Taree-Wingham road about three miles from Taree. (Portion 77, Parish of Taree.)

A gully through portion 78 indicates that the limestone is continuous between the two last-named outcrops.

The two first-mentioned occurrences may be lenticular beds but, most probably, they are faulted portions of the more continuous bed to the west. It is a reasonable assumption that more limestone occurs in this neighbourhood but does not outcrop.

Woolnough (1911, p. 66) described the limestone from the Taree Rifle Range, presumably from the third locality cited or thereabouts. He stated that the greyish-brown oolitic rock passed into handsome reddish marble along the Cedar Party road. This marble, however, belongs to the Kamilaroi sequence, the Cedar Party road crossing over from one limestone band to the other. Carne and Jones (1919, pp. 273, 274) described the Taree Limestone and quarrying operations carried out upon it. Like Woolnough, they regarded the deposits along the Cedar Party road as continuations of the same belt.

The limestone is light grey, dark grey or greyish-brown in colour, massive and oolitic in places. Crinoid ossicles are frequently found and corals have been reported from the Taree quarry on portion 18, Parish of Taree. These are as follows: *Aphrophyllum hallense* Smith (David, 1932, p. 59; Hill, 1933, p. 73), *Aphrophyllum* cf. *hallense* Smith (Collected Dr. G. D. Osborne. Exhibited to Roy. Soc. N.S.W., 1930), *Carcinophyllum*? (Collected by W. M. Allan. Identified Dr. I. Brown), *Lithostrotion stanvellingense* Eth. fil. (Collected Dr. G. D. Osborne. Identified Dr. I. Brown), *Lithostrotion columnare* Eth. fil. (Collected Dr. G. D. Osborne. Identified Dr. I. Brown).

The corals indicate a Viséan age for the Taree Limestone.

Occasional bands of calcareous shales are present in the limestone unit and together with it make up a thickness of about 200 feet in places.

Poor outcrops characterize the mudstones and sandstones which overlie the Taree Limestone. A thickness of about 150 feet is inferred in the vicinity of the Taree Rifle Range, but a greater thickness is suggested further to the east where there is a greater extent of country between the limestone and the base of the Kullatine Series.

The total measured thickness of the Upper Burindi Series is of the order of 750 feet, but possibly the thickness reaches 1,000 feet in places.

Kullatine Series.

A belt of rocks belonging to the Kullatine Series runs from the Dawson River just north of Taree in a north-westerly direction to Cedar Party Creek. Similar beds outcrop to the north of Wingham and run northward through Khatabunda to form a high ridge. Owing to their resistance to erosion, members of this series always tend to form hills while the adjacent rocks of the Upper Burindi Series and Macleay Series are easily eroded and give rise to lower country on each side.

The Kullatine Series consists principally of tuffs and tillites, but the olive-green mudstone so typically developed in the Lower Burindi Series is absent.

A conglomerate which runs through the Taree Rifle Range and continues south-east to the railway line about two miles north of Taree has been taken as the basal bed of the series. This conglomerate is dark grey in colour, weathering to white and light-grey. It consists of well-rounded pebbles of chert, quartzite, felsite, quartz, and other hard rocks set in a tuffaceous matrix. These pebbles are usually less than four inches in diameter and commonly are 1 to 1½ inches. The smaller fragments comprise felspar, chert, quartz, and tuffaceous chloritic material.

North of Taree the conglomerate is overlain by gritty tuffs and fine-grained conglomerates into which the coarser bed passes without any well-defined line of demarcation. Small rounded pebbles are scattered throughout the next few hundred feet of the sequence and indicate sorting of the material by running water.

Some of the gritty tuffaceous rocks consist of sub-angular and rounded quartz and chert grains less than one-tenth inch in diameter set in a groundmass of green chloritic material. In other lighter-coloured types the pebbles are mostly chert, probably of volcanic origin, and are angular to sub-angular in shape. They grade into breccias and tuffaceous conglomerates, with increases in the size of the rock fragments.

Most of these rocks are white, cream, and light or dark green, but on weathering they are stained brown by iron oxides. Higher in the sequence the tuffs become darker and finer in grain. They are frequently grey and dark green and are associated with bands of green chert containing fragmental plant remains

which suggest the presence of *Rhacopteris*. No definite identifications of the fragments could be made.

The conglomerates, tuffs, and cherts are overlain by tillite with some tuff beds. It is interesting to note that the tillite was first mentioned by Woolnough (1911), who suggested that a "bluish gritty bed, almost a breccia in places", immediately below the Cedar Party Limestone might be glacial in origin. The tillite is dark bluish-grey in colour and is speckled with numerous angular and sub-angular inclusions of granites, felsites, andesites, cherts, quartzites, tuffs, and other rock types. The larger pebbles are rounded, suggesting water-sorting of some of the material. A much better development of the glacial rock is found elsewhere in the Manning River District, and at Taree its thickness is less than that measured at any other place. A particularly spectacular occurrence is that near Khatabunda Trigonometrical Station.

The tuffs interbedded with the tillite are generally dark grey or bluish-grey, massive, and of variable grainsize. Some of the finer-grained phases may pass into varve-shales, but no definite evidence of these rocks was found. Tuffs occupy the topmost portion of the sequence beneath the Macleay Series.

A section of the Kullatine Series was measured across the hills behind the Taree Rifle Range.

	Approximate Thickness (feet).
Tuff with subordinate tillite	500
Tillite	200
Fine-grained grey tuffs	50
Pale blue cherty tuffs	140
Grey tuffs	150
Conglomerates and gritty tuffs	300
Total thickness	1,340

The beds dip in a direction 25 degrees at 45 degrees. The light-coloured beds are grouped with the conglomerates and gritty tuffs at the base of the section but they apparently increase in thickness to the east. The tillites thicken to the west but it is not considered likely that the tillites and tuffs pass into one another laterally.

KAMILAROI.

Macleay Series.

Immediately above the tillites and tuffs of the Kullatine Series between Taree and Cedar Party are conglomerates or tuffs constituting the lowest beds of the Macleay Series. The conglomerates are discontinuous, but, when present, are very interesting. One outcrop occurs behind the Taree Rifle Range overlying the section which was measured in connection with the Kullatine Series. This rock consists of angular, sub-angular and rounded pebbles of granite, granite-porphyry, tuff, chert, quartzite, quartz, etc., reaching a diameter of 6 inches.

Crinoid stems and *Monilopora* were found in the matrix of the conglomerate.

The tuffs are purple in colour and speckled with yellow, white, red, and green, so that they have a somewhat spectacular appearance. Pebble bands in these tuffs are common. Sponge spicules occur in a bed at the top of this unit and coarser tuff beds containing marine fossils follow. The forms collected from these beds include: *Productus* sp. indet., *Linoproductus springsurensis* Booker, *Linoproductus cora* var. *farleyensis*, *Platyschisma rotundatum* Morris. (Specimens F 38043-44, Aust. Museum Collection.)

Soft green tuffs overlie the fossiliferous beds and, in turn, are succeeded by the Cedar Party Limestone. This rock is light grey, pink or reddish in colour and is crystalline, resembling a marble. It contains, however, very well preserved marine fossils and consists largely of the remains of crinoids. Forms collected from the belt are as follows: *Fenestella* spp. indet., *Stenopora* (small dendroid form), Crinoid stems, *Aviculopecten* sp., *Eurydesma* sp.

Dr. Dorothy Hill has identified corals from the limestone as *Zaphrentis* sp., *Michelinia* sp. (probably related to *M. indica* Waagen & Wentzel from the Permo-Carboniferous of the Salt Range, India), and *Euryphyllum* sp. Hill.

She states that the crinoidal limestone is probably that which characterizes the Cyathaxonia phase of the European Carboniferous or Permian.

The limestone is overlain by soft grey micaceous mudstones which are notorious for their failure to outcrop, being found only in cuttings and on recently eroded slopes. They give rise to a pale-grey micaceous soil, sandy in places, and this is indicative of the presence of the beds.

The following section was measured along the Cedar Party road about half a mile north of its junction with the Taree-Wingham road at about three miles from Taree.

	Thickness in feet.
Micaceous mudstone	?
Cedar Party Limestone	400?
Soft green tuffs with marine fossils	55
Coarse tuff with marine fossils	30
Tuff with <i>Linoproductus</i> , etc.	10
Tuff with sponge spicules in chalcedony	10
Speckled pebbly tuff	70
Total thickness	575 + feet

Carne and Jones (1919) recorded a number of outcrops of limestone in the parish of Wingham. These may be connected with each other to form a synclinal structure striking ENE-WSW and pitching to the ENE. The northern limb runs towards the Comboyne while the southern swings round towards the Manning River. The best exposures are found between Stony Creek and the Wingham Rifle Range. West of the Rifle Range the limestone is underlain by pebbly tuffs containing marine fossils. These tuffs correspond to those on the Taree-Cedar Party road, but differ from them in appearance, being harder and grey in colour. Associated with them east of the Rifle Range between the Wingham-Comboyne road and Western's Quarry is a conglomerate containing spirifers.

Few outcrops of beds overlying the limestone have been found, but about three miles from Wingham beside the Comboyne road a coarse tuff containing crinoid stems outcrops. This is in a position where micaceous mudstones might be expected. It is necessary to point out, however, that the faulting which is prevalent in the area could give rise to anomalous occurrences which, on account of the poor outcrops, often defy satisfactory explanation.

Pleistocene to Recent.

High-level river-gravels are seen alongside the Wingham-Taree road near the junction with the Wingham-Cedar Party road and they cover nearly a square mile of country near Kolodong. These gravels are comparable with those found in the valleys of all of the coastal rivers and have a similar history (Voisey, 1934b). They are probably Pleistocene in age.

Terraced alluvial flats beside the Manning River belong to the present cycle of erosion and attain a width of nearly a mile.

IGNEOUS ROCKS.

Tertiary.

Alkaline Intrusives.

Two plugs of alkaline rocks occur within the area shown on the map. One gives rise to the hills in the Rifle Range at Wingham and the other constitutes a small knob just south of a branch road which runs westward off the Moorall Creek road a mile west of its junction with the Wingham-Comboyne road.

These plugs are members of a group of intrusions which have been injected into the sediments in many places between Wingham and Wauchope, notably near Upper Lansdowne. Several of them invade Triassic beds and they are believed to be Tertiary in age.

It is hoped that it will be possible to make a petrological study of these rocks at a later date.

STRUCTURAL GEOLOGY.

1. *Devonian.*

On account of their relative incompetence the Devonian beds have yielded to the stresses applied to them to the extent that they have been thrown into a series of folds of small amplitude. The axes of the folds have been variable, but between Wingham and Tinonee an east-west trend has been maintained. All the folds examined have been so severely faulted at the crests of the anticlines and troughs of the synclines that the beds in those positions are vertical or overturned. Some idea of the intensity of the folding may be gained by a study of the railway cuttings between Wingham and Killawarra and of the Brushy Cutting section.

2. *Carboniferous and Kamilaroi.*

The Carboniferous and Kamilaroi strata have been folded on a meridional axis into anticlines and synclines. So great was the pressure, however, that fracturing took place and the folds are broken and deformed.

The Carboniferous beds between Kolodong and Cedar Party Creek occupy the core of an anticline pitching in a northerly direction and fractured by the Cedar Party Fault.

The Kamilaroi beds along the Wingham-Comboyne road and those east of the Taree-Cedar Party road are in synclines on each side of this anticline. The Cedar Party Limestone is a useful horizon for indicating these structures since it swings round in conformity with them.

With the exception of the Wingham Fault all the fractures indicated on the map appear to be related to the folding. The southerly dip of the beds in the neighbourhood of the Devil's Elbow is not in accordance with the antichinal structure.

The positions of the faults in that locality, as shown on the map, are approximate only, but wherever they are placed it is a matter of some difficulty to explain their presence and the anomalous dip of the beds.

3. *The Wingham Fault.*

The Wingham Fault is a most important structure separating Devonian from Carboniferous and Kamilaroi beds. It cuts across the folded structures and is evidently younger. It appears to be a normal fault.

Age of the Folding and Faulting.

Since the folding involves beds of Kamilaroi age it must have taken place some time after the close of the sedimentary phase of that period. Triassic beds unconformably overlie folded Carboniferous and Kamilaroi beds a short distance to the north of the area. It is apparent, therefore, that the folding and the faulting associated with such folding took place during the diastrophic period at the close of the Palaeozoic Era—The Hunter-Bowen Movement (Carey and Browne, 1938).

The Wingham Fault probably belongs to the later stages of the orogeny, but there is no definite evidence to prove that it was not formed at a much later date.

There is nothing to indicate that the Devonian beds suffered any folding prior to the deposition of the Carboniferous and Kamilaroi beds.

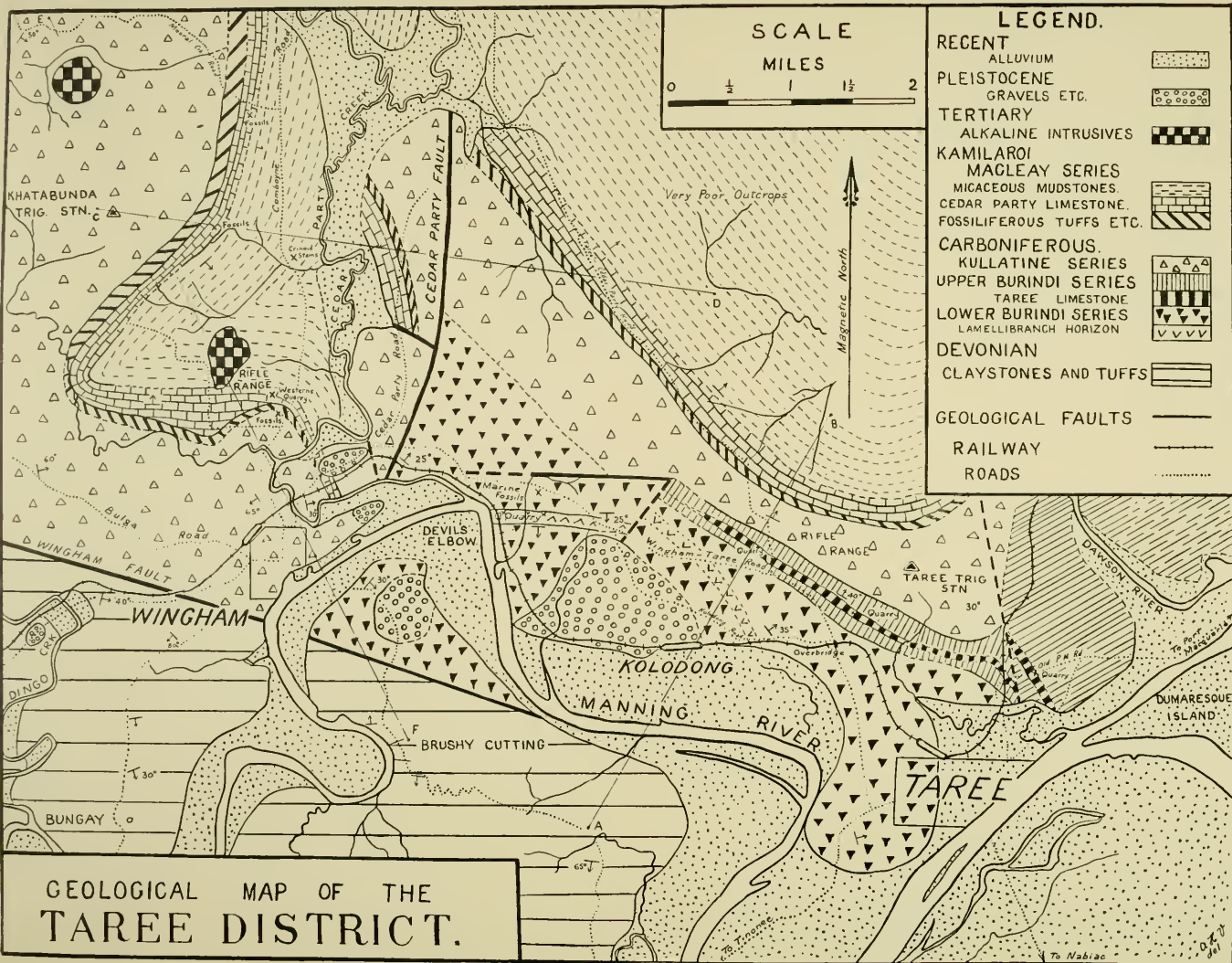
Acknowledgements.

I desire to thank Professor W. R. Browne and Dr. G. D. Osborne of the University of Sydney for their help and advice in connection with the compilation of the manuscript.

My thanks are due also to Dr. Ida Brown, Dr. Dorothy Hill and Mr. H. C. Fletcher for identifying the fossils. Mr. Fletcher has kindly catalogued them and included them in the Australian Museum Collection.

Publications to which Reference has been Made.

- BENSON, W. N., 1913.—The Geology and Petrology of the Great Serpentine Belt of N.S.W. Part 1. Introduction, etc. *PROC. LINN. SOC. N.S.W.*, xxxviii.
- , 1916.—The General Geology of the Gloucester District. *Journ. Roy. Soc. N.S.W.*, 1.
- CAREY, S. W., and BROWNE, W. R., 1938.—Review of the Carboniferous Stratigraphy, etc. *Journ. Roy. Soc. N.S.W.*, lxxii.
- CARNE, J. E., and JONES, L. J., 1919.—The Limestone Deposits of New South Wales. *N.S.W. Geol. Surv., Min. Res. No. 2.*
- CAREY, S. W., 1937.—The Carboniferous Sequence in the Werrie Basin. *PROC. LINN. SOC. N.S.W.*, lxii.
- DAVID, T. W. E., 1932.—Explanatory Notes to accompany a New Geological Map of the Commonwealth of Australia.
- HILL, DOROTHY, 1933.—The Lower Carboniferous Corals of Australia. *Proc. Royal Soc. Q'ld.* xlv.
- OSBORNE, G. D.—Exhibit to Geological Section of the Royal Society. *Journ. Roy. Soc. N.S.W.*, lxiv, 1930, p. xxiii.
- SUSSMILCH, C. A., 1921.—The Geology of the Gloucester District. *Journ. Roy. Soc. N.S.W.*, lv.
- VOISEY, A. H., 1934a.—Geology of the Middle North Coast District, N.S.W. *PROC. LINN. SOC. N.S.W.*, lix.
- , 1934b.—The Physiography of the Middle North Coast District, N.S.W. *Journ. Roy. Soc. N.S.W.*, lxviii.
- , 1936.—The Upper Palaeozoic Rocks Around Yessabah, near Kempsey, N.S.W. *Journ. Roy. Soc. N.S.W.*, lxx.
- WOOLNOUGH, W. G., 1911.—Preliminary Note on the Geology of the Kempsey District. *Journ. Roy. Soc. N.S.W.*, xlv.



THE GEOLOGY OF THE ARMIDALE DISTRICT.

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(Two Text-figures.)

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The City of Armidale is situated on the New England Tableland, 360 miles by railway from Sydney.

In connection with investigations into the stratigraphy of the Upper Palaeozoic rocks of New South Wales, the writer had occasion to pay two visits to the district during the early part of 1933.

Preparation of a sketch-map was facilitated by the presence of numerous roads. This map must be revised when it is possible for more accurate work to be carried out. It is suggested that the rock boundaries could be surveyed by the geology students of the educational establishments in the district.

The heights indicated on the map were obtained by means of an aneroid and are approximate only.

STRATIGRAPHY.

Carboniferous (?).

(1) Mudstones, Sandstones and Tuffs.

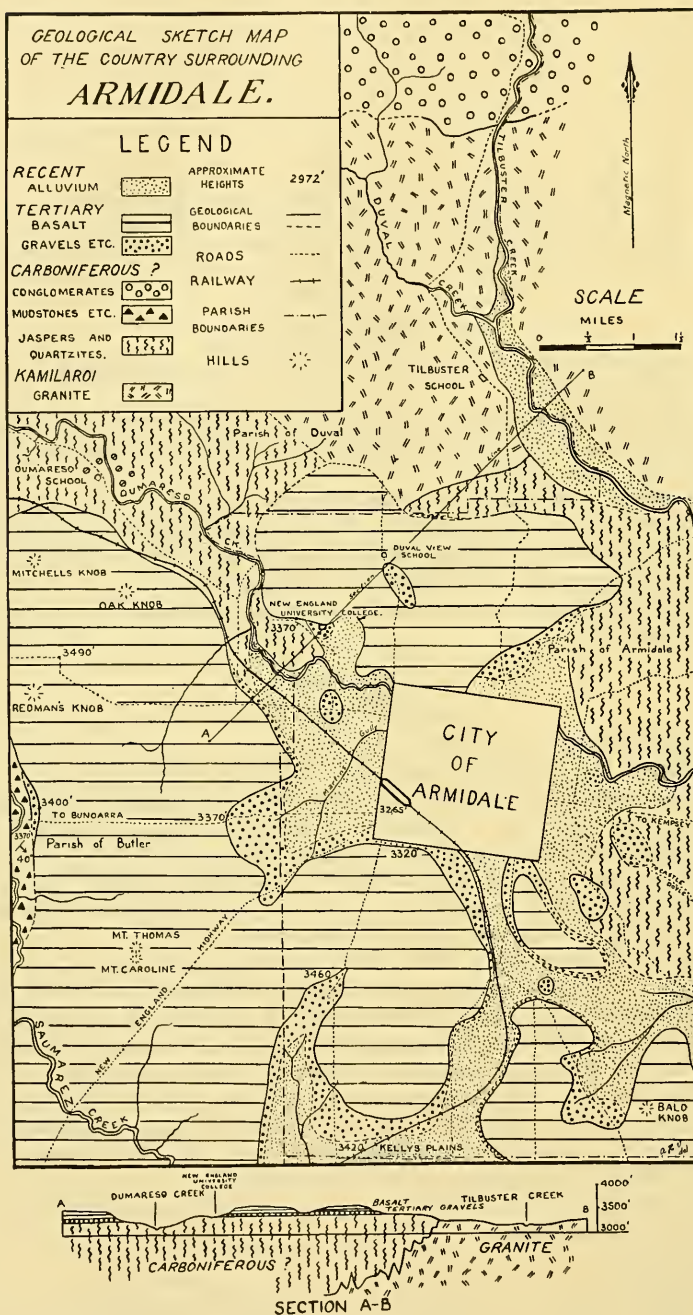
Sedimentary rocks outcrop around the bridge over Saumarez Creek, where it is crossed by the Bundarra Road, $4\frac{1}{2}$ miles west of Armidale. These consist of thinly-bedded mudstones and tuffaceous (?) sandstones, together with occasional thicker bands of tuff. The mudstones are grey when fresh, but weather to a buff colour. Lamination is conspicuous in some of the coarser bands. Some beds of fine-grained green cherty mudstones occur. Fragmental plant-remains were the only fossils found. The strata dip south-east at 40° .

The age of the rocks is uncertain, but they are probably part of a widespread series occurring to the north-west around Bundarra and Ashford. These areas are marked as Kamilaroi and Lower Carboniferous on Professor Sir T. W. E. David's map of the Commonwealth of Australia, 1932. However, the Saumarez Creek beds and those around Bundarra are unlike Kamilaroi rocks elsewhere in the State and must be limited to the Carboniferous or Devonian suites. The writer found crinoid ossicles in gritty tuffs 32 miles from Armidale along the Bundarra road. These tuffs and the olive-green mudstones associated with them closely resemble the Burindi beds of the Hunter and Manning districts.

Lacking definite fossil evidence, the age of the beds can be put down, tentatively only, as Carboniferous.

(2) Conglomerates.

The writer's attention was drawn to an unusual conglomerate by the Rev. Norman McKie of Guyra. Lithologically, it resembles a conglomerate described by the writer from the lower portions of the Kullatine Series (Voisey, 1934), but,



according to Professor Browne (verbal communication), it is similar to some of Devonian age which he had examined. The conglomerate contains a variety of pebbles, most being rounded and ranging up to a foot in diameter. The matrix is dark grey and apparently tuffaceous.

The conglomerate and associated subordinate tuffs outcrop along the New England Highway between the 9 and 12 mile-pegs going north from Armidale. They give way to mudstones and tuffs resembling those at Saumarez Creek at the Devil's Pinch immediately to the north.

What appears to be the same conglomerate outcrops around Dumaresq School. It has been contact metamorphosed and is associated with other altered rocks. This occurrence is a strong argument in favour of a correlation between the mudstones, tuffs and conglomerates described above and the jaspers and quartzites to be described in the next section.

(3) Jaspers and Quartzites.

Immediately to the east of Armidale are jaspers, quartzites and other hard siliceous rocks which form ridges trending north and south in conformity with the general strike of the country. They outcrop also between the New England University College and Dumaresq Creek and continue on both sides of the creek for some miles to the north-west.

The jaspers are red or pink in colour, very hard and highly jointed. They grade into white and greenish quartzites. White quartz veins interlace the rocks and line cavities in them.

Earlier maps, including Professor Sir T. W. E. David's map of the Commonwealth, show all the sedimentary and metamorphic rocks around Armidale as Silurian, together with the phyllites, slates, etc., occurring further to the east. This procedure is not supported by field evidence, which suggests that the beds are much younger and owe their extreme alteration to contact metamorphism for which granite which surrounds the area is responsible. No slates or phyllites were found within the parishes mapped.

Tertiary.

White quartz gravels and ferruginous sandstones outcrop around the margins of the basalt in a number of places. They represent stream deposits laid down during Tertiary and perhaps Mesozoic times. Grey billy is not uncommon and was found in the following localities: (a) Portion 52, Parish of Armidale, about 2½ miles south of Armidale, (b) near Duval View public school, (c) near Bald Knob beside the old Walcha Road in Portion 550, Parish of Armidale.

Dr. G. D. Osborne (1929) found leaves and other plant remains in ferruginous rocks at Armidale in the Tertiary sediments. One piece of ironstone contained what appeared to be an insect's wing.

The deposits are discontinuous and the basalt often is found resting directly upon the Upper Palaeozoic rocks. They do not appear to be very thick, but reach approximately 30 feet in portion 111, Parish of Butler, near the bridge over Saumarez Creek on the Armidale-Bundarra road, and may exceed this thickness somewhat in other localities.

Recent.

Alluvium composes the flats on each side of Dumaresq Creek. The soil is black in colour owing to the disintegration of basalt which caps the adjacent hills. Red soil, also derived from the basalt, covers many hillsides, obscuring the Tertiary sediments but frequently found to contain pebbles shed from them. This